



## LMNB1 gene

lamin B1

### Normal Function

The *LMNB1* gene provides instructions for making the lamin B1 protein. Lamin B1 is a structural protein called an intermediate filament protein. Intermediate filaments provide stability and strength to cells. Lamin B1 is a scaffolding (supporting) component of the nuclear envelope, which is the structure that surrounds the nucleus in cells. Specifically, this protein is located in the nuclear lamina, a mesh-like layer of intermediate filaments and other proteins that is attached to the inner membrane of the nuclear envelope. As part of the nuclear envelope, lamin B1 helps regulate the movement of molecules into and out of the nucleus. The protein also plays a role in the copying (replication) of DNA in preparation for cell division and the activity (expression) of many genes by being involved in the organization of chromosomes within the nucleus.

### Health Conditions Related to Genetic Changes

#### autosomal dominant leukodystrophy with autonomic disease

At least 30 mutations in the *LMNB1* gene have been found to cause autosomal dominant leukodystrophy with autonomic disease (ADLD). This condition is characterized by nervous system abnormalities due to the loss of myelin, which is a fatty substance that insulates nerve fibers and promotes the rapid transmission of nerve impulses. People with ADLD begin to have autonomic nervous system problems, such as difficulty with bowel and bladder function, in their thirties or forties. The autonomic nervous system controls involuntary body processes such as the regulation of blood pressure and body temperature. Affected individuals then develop movement problems that slowly worsen over time.

Nearly all cases of ADLD result from an abnormal extra copy (duplication) of the *LMNB1* gene. As a result of this duplication, more lamin B1 is produced than normal. In rare cases, a deletion of genetic material near the beginning of the *LMNB1* gene leading to increased production of lamin B1 causes ADLD. While lamin B1 is found in cells throughout the body, it appears that cells in the brain are especially sensitive to changes in lamin B1. Cells called oligodendrocytes, which help coat nerve cells with myelin, seem to be particularly affected. Increased lamin B1 activity leads to decreased expression of genes that are important for myelin function. Additionally, an increase in the amount of lamin B1 in cells leads to a hardening of the nuclear envelope, which can cause problems with cell function. These changes lead to reduced myelin production and maintenance over time.

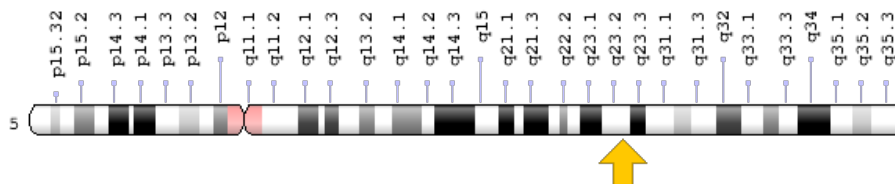
In at least one family with ADLD, the condition is instead caused by a loss (deletion) of genetic material near the beginning of the gene. It is thought that this deletion removes a regulatory region of DNA that helps control the expression of the *LMNB1* gene. As a result of the loss of this region, *LMNB1* is overexpressed and production of the lamin B1 protein is increased, similar to the cases that are caused by *LMNB1* duplication.

In people with ADLD, the loss of myelin (demyelination) occurs in the brain and spinal cord (central nervous system), often years before movement problems develop. Demyelination of the spinal cord likely contributes to the autonomic nervous system problems by impairing transmission of nerve signals from the brain to the body. The movement problems are probably due to demyelination in the region of the brain involved in coordinating movements (the cerebellum) and of the nerve cells that extend down the spinal cord (corticospinal tracts) and control voluntary muscle movement.

### Chromosomal Location

Cytogenetic Location: 5q23.2, which is the long (q) arm of chromosome 5 at position 23.2

Molecular Location: base pairs 126,776,623 to 126,837,020 on chromosome 5 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

### Other Names for This Gene

- LMN
- LMN2
- LMNB

## **Additional Information & Resources**

### Educational Resources

- Madame Curie Bioscience: Major Components of the Peripheral Nuclear Lamina  
<https://www.ncbi.nlm.nih.gov/books/NBK6125/#A13129>
- Molecular Biology of the Cell (fourth edition, 2002): The Nuclear Envelope (figure)  
<https://www.ncbi.nlm.nih.gov/books/NBK26932/figure/A2155/?report=objectonly>
- The Cell: A Molecular Approach (second edition, 2000): Intermediate Filaments  
<https://www.ncbi.nlm.nih.gov/books/NBK9834/>

### GeneReviews

- Autosomal Dominant Leukodystrophy with Autonomic Disease  
<https://www.ncbi.nlm.nih.gov/books/NBK338165>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28LMNB1%5BTIAB%5D%29+OR+%28lamin+B1%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1440+days%22%5Bdp%5D>

### OMIM

- LAMIN B1  
<http://omim.org/entry/150340>

### Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
[http://atlasgeneticsoncology.org/Genes/GC\\_LMNB1.html](http://atlasgeneticsoncology.org/Genes/GC_LMNB1.html)
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=LMNB1%5Bgene%5D>
- HGNC Gene Family: Lamins  
<http://www.genenames.org/cgi-bin/genefamilies/set/612>
- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=6637](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=6637)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/4001>
- UniProt  
<http://www.uniprot.org/uniprot/P20700>

## Sources for This Summary

- Bartoletti-Stella A, Gasparini L, Giacomini C, Corrado P, Terlizzi R, Giorgio E, Magini P, Seri M, Baruzzi A, Parchi P, Brusco A, Cortelli P, Capellari S. Messenger RNA processing is altered in autosomal dominant leukodystrophy. *Hum Mol Genet*. 2015 May 15;24(10):2746-56. doi: 10.1093/hmg/ddv034. Epub 2015 Jan 30.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/25637521>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4406291/>
- Ferrera D, Canale C, Marotta R, Mazzaro N, Gritti M, Mazzanti M, Capellari S, Cortelli P, Gasparini L. Lamin B1 overexpression increases nuclear rigidity in autosomal dominant leukodystrophy fibroblasts. *FASEB J*. 2014 Sep;28(9):3906-18. doi: 10.1096/fj.13-247635. Epub 2014 May 22.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/24858279>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4139899/>
- Giorgio E, Robyr D, Spielmann M, Ferrero E, Di Gregorio E, Imperiale D, Vaula G, Stamoulis G, Santoni F, Atzori C, Gasparini L, Ferrera D, Canale C, Guipponi M, Pennacchio LA, Antonarakis SE, Brussino A, Brusco A. A large genomic deletion leads to enhancer adoption by the lamin B1 gene: a second path to autosomal dominant adult-onset demyelinating leukodystrophy (ADLD). *Hum Mol Genet*. 2015 Jun 1;24(11):3143-54. doi: 10.1093/hmg/ddv065. Epub 2015 Feb 20.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/25701871>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4424952/>
- Giorgio E, Rolyan H, Kropp L, Chakka AB, Yatsenko S, Di Gregorio E, Lacerenza D, Vaula G, Talarico F, Mandich P, Toro C, Pierre EE, Labauge P, Capellari S, Cortelli P, Vairo FP, Miguel D, Stubbolo D, Marques LC, Gahl W, Boespflug-Tanguy O, Melberg A, Hassin-Baer S, Cohen OS, Pjontek R, Grau A, Klopstock T, Fogel B, Meijer I, Rouleau G, Bouchard JP, Ganapathiraju M, Vanderver A, Dahl N, Hobson G, Brusco A, Brussino A, Padiath QS. Analysis of LMNB1 duplications in autosomal dominant leukodystrophy provides insights into duplication mechanisms and allele-specific expression. *Hum Mutat*. 2013 Aug;34(8):1160-71. doi: 10.1002/humu.22348. Epub 2013 May 28. Erratum in: *Hum Mutat*. 2014 Jan;35(1):149.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/23649844>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3714349/>
- Heng MY, Lin ST, Verret L, Huang Y, Kamiya S, Padiath QS, Tong Y, Palop JJ, Huang EJ, Ptáček LJ, Fu YH. Lamin B1 mediates cell-autonomous neuropathology in a leukodystrophy mouse model. *J Clin Invest*. 2013 Jun;123(6):2719-29. doi: 10.1172/JCI66737. Epub 2013 May 15.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/23676464>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3668844/>
- OMIM: LAMIN B1  
<http://omim.org/entry/150340>
- Padiath QS, Saigoh K, Schiffmann R, Asahara H, Yamada T, Koeppen A, Hogan K, Ptáček LJ, Fu YH. Lamin B1 duplications cause autosomal dominant leukodystrophy. *Nat Genet*. 2006 Oct;38(10):1114-23. Epub 2006 Sep 3. Erratum in: *Nat Genet*. 2007 Feb;39(2):276.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/16951681>
- Rolyan H, Tyurina YY, Hernandez M, Amoscato AA, Sparvero LJ, Nmezi BC, Lu Y, Estécio MR, Lin K, Chen J, He RR, Gong P, Rigatti LH, Dupree J, Bayir H, Kagan VE, Casaccia P, Padiath QS. Defects of Lipid Synthesis Are Linked to the Age-Dependent Demyelination Caused by Lamin B1 Overexpression. *J Neurosci*. 2015 Aug 26;35(34):12002-17. doi: 10.1523/JNEUROSCI.1668-15.2015.  
*Citation on PubMed:* <https://www.ncbi.nlm.nih.gov/pubmed/26311780>  
*Free article on PubMed Central:* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4549407/>

---

Reprinted from Genetics Home Reference:  
<https://ghr.nlm.nih.gov/gene/LMNB1>

Reviewed: September 2016  
Published: March 21, 2017

Lister Hill National Center for Biomedical Communications  
U.S. National Library of Medicine  
National Institutes of Health  
Department of Health & Human Services